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Report of the

# FIRST GROUP FELLOWSHIP SEMINAR/STUDY TOUR ON FREEZING AND CANNING OF FISH AND INDUSTRIALIZATION OF BY-PRODUCTS

U.S.S.R., 12 May - 6 June 1967

FISH TECHNOLOGY EXPERIMENT STATION
C.F.T.R.I.
MANGALORE.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

ROME, 1968

UNITED NATIONS DEVELOPMENT PROGRAM No. TA 2495

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Rome, 1968

FAO UNITED NATIONS DEVELOPMENT PROGRAM (TECHNICAL ASSISTANCE)

REPORTS ON FISHERIES

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Special thanks are offered to Dr. A. S. Bogdanov, Dr. Tamara Makarova and Dr. S. Federov for their valuable collaboration in ensuring that the objectives of the Study Tour were realized.

No tour is without its problems. That these were so few and so quickly solved, reflects the efficiency and hard work of Mr. M. Kazarnovsky and his Soviet colleagues who were responsible for all arrangements for accommodation and travel.

The 14 participants very quickly demonstrated a high standard of ability and judgment which, coupled with their affability and enthusiasm, made the tour a most satisfactory professional and personal experience. This fact FAO is happy to record.

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## SUMMARY

The first seminar study tour on fish processing was held in the U.S.S.R. from 12 May to 6 June 1967 by the Food and Agriculture Organization of the United Nations (FAO) in co-operation with the Government of the U.S.S.R. under the United Nations Development Program (Technical Assistance).

Fourteen highly qualified participants from nine developing countries - Africa (two), Asia (three) and Latin America (four) - had the opportunity to become acquainted with the fish processing, storage and distribution techniques and developments as practised in the U.S.S.R. at sea and on shore.

An eight-day period of lectures in Moscow was followed by visits to fish processing plants, freezer trawlers, factoryships, a barrel-manufacturing plant as well as research institutes and fishery schools. Lectures in fish inspection and quality control were given by the FAO guest lecturer during the Study Tour.

The technological laboratories of the All-Union Research Institute for Marine Fisheries and Oceanography in Moscow were visited at the end of the Study Tour, and a summing-up panel, formed by all the participants, evaluated the benefits gained from their attendance at this Seminar/Study Tour.

# INTRODUCTION

With the rapid expansion and profound changes in maritime fisheries and the continuous enlargement of long-range fishing fleets, a steadily increasing landing of fish is observed everywhere whereas sometimes the facilities for its industrial utilization and distribution to consumers have not kept pace consistently with the fishing development.

Many developing countries are very interested in freezing and canning fish, including quality control of their fishery products, and in the industrialization of their by-products on land and on board factory ships. One of the main obstacles, however, is the lack of sufficiently trained and experienced personnel with the necessary knowledge for planning the development and further implementation of such industries. Therefore decisions in selecting suitable equipment and arrangements for operating the plants are often made without taking into account the important influence of local conditions so that the installations do not meet the requirements for a successful operation.

The Soviet Government agreed to hold a Group Fellowship Seminar/Study Tour on the Freezing and Canning of Fish and Industrialization of By-products as proposed by the Food and Agricultural Organization of the United Nations (FAO) under the United Nations Development Program (Technical Assistance) scheme from 12 May to 5 June 1967. The VNIRO (All-Union Scientific Research Institute for Marine Fisheries and Oceanography) in Moscow, as the executive agency in the U.S.S.R., made all local arrangements concerning the program agreed upon for this first Seminar/Study Tour (called Study Tour throughout the text) and its implementation and administration.

## 1. OBJECTIVE OF THE SEMINAR/STUDY TOUR

The purpose of this Study Tour was to acquaint fishery officers, fishery technologists and research workers of developing countries with the practice of freezing and canning at sea and ashore. Aspects of planning and operation of fish processing establishments as well as of distribution and marketing of fishery products were taken into consideration. Problems connected with freezing fish and the distribution of frozen fish products over long distances in a hot climate were studied. Quality aspects and problems of inspection were also discussed, and the education and training of fish processing technologists at intermediate levels as well as the actual facilities were considered.

## 2. CONDUCT OF THE SEMINAR/STUDY TOUR

A very homogeneous group of participants representing nine different developing countries, well-qualified and with the necessary experience to derive benefit from the lectures, the discussions and the numerous field visits took part in this Study Tour.

### Location

The Altai Hotel was chosen as a base for this Study Tour. A conference room was made available for the lectures in one of the buildings of this hotel. The FAO and Soviet secretariats were established in two rooms of the building. Accommodation for all the participants was arranged in the same hotel.

## Opening ceremony

The opening ceremony was held on 15 May 1967 under the chairmanship of Dr. A. S. Bogdanov, Director of VNIRO. He was assisted by B. G. Kulikov, Chief of the Foreign Department of the All-Union Ministry of Fisheries, M. Kazarnovsky, Director of the Study Tour, P. Javoronkov, GKES representative and Dr. R. Kreuzer (FAO), Co-director of the Seminar/Study Tour. Also in attendance were Dr. P. A. Moiseev, Deputy Director of VNIRO, Dr. S. G. Fedorov, Chief, International Fishery Division, VNIRO, Dr. N. Sysoev, Chief, Economic Research Department, VNIRO, etc.

In his opening speech, the Chairman referred to the fact that this Study Tour was the first one on fish processing to be organized in the U.S.S.R. in collaboration with FAO under the UNDP(TA) scheme.

Mr. Kulikov pointed out the value of these training programs for the future work of the participants in their own developing countries.

Mr. Javoronkov (GKES) gave a brief account of the growth of these Soviet Study Tours in collaboration with several United Nations Specialized Agencies, with particular reference to FAO, and spoke of the aims of such training, from which more than 50 developing countries have already benefited. He concluded by saying that GKES would do its best to make the stay of the participants both pleasant and useful to their future work and increased experience.

Mr. Kazarnovsky, on behalf of the Administration, welcomed the participants and gave a brief resumé of the established program of lectures and visits to fishery facilities in Murmansk and Astrakhan in order to enable them to see for themselves fishing, processing, cold storage and distribution practiced in the U.S.S.R.

Dr. Kreuzer, Co-director of the Study Tour, spoke on behalf of FAO and thanked the Soviet officials and scientists for the time and effort they devoted to assisting FAO in its fishery training programs for the benefit of developing countries.

On behalf of the participants, A. Padmanabhan (India) expressed their gratitude to FAO and the Soviet authorities for having given them the opportunity to benefit from this kind of technical assistance rendered to their countries, and said that the participants would do their utmost to learn as much as possible about the achievements of the U.S.S.R. in fish processing.

## Lecture period

The official opening of the Study Tour was followed by an 8-day period of lectures on the topic of fish processing. Two afternoons were devoted to discussing the participants' reports on fish processing in their own countries.

## Field visits

After the lectures the participants proceeded to Murmansk - from 24 to 26 May - and Astrakhan - from 30 May to 3 June. Visits were made to fish freezing and canning plants, cold stores, a barrel-manufacturing plant, a fish meal plant, freezer trawlers and factoryships, as well as research institutes and a fishery school. An account of the visits and discussions is given in Chapter 4.

Lectures on fish inspection and quality control were given by H. Dempsey, FAO guest lecturer.

On 5 June, a visit was paid to VNIRO and its technological laboratories in Moscow.

In the meeting room of this Institute, a summing-up panel was formed of all participants, under the chairmanship of H. Pimentel (Peru), to evaluate the benefits gained from participation in the Study Tour.

Closing ceremony

The Study Tour ended with a ceremony in VNIRO's meeting room on 5 June 1967 at 17.00 under the chairmanship of Dr. Tamara Makarova, Deputy Director of VNIRO. Dr. Makarova, in addressing the participants on behalf of the Soviet authorities, expressed her satisfaction at the results gained from the open discussion of common problems in fish utilization and her appreciation of the useful suggestions received from the participants and FAO lecturers on future developments in the full utilization of fish resources and on problems concerning fish inspection and quality control.

The participants spoke individually, offering their thanks to FAO and the Soviet authorities and scientists for the opportunity presented to them of acquiring new knowledge and experience in fish processing which will prove of great value in the development programs of their countries.

Dr. Makarova distributed certificates to the participants.

## 3. STRUCTURE OF THE FISHERY SERVICES IN THE U.S.S.R.

Organization of the Ministry of Fisheries

In the U.S.S.R., the Ministry of Fisheries is responsible, inter alia, for the propagation and harvesting of fish, and for the processing and quality control of fish and fish products. Through its specialized research institutes, the Ministry undertakes fundamental, applied and developmental research in fishery biology, technology and oceanography.

For fishery administration, the U.S.S.R., is divided into five regional management units, or "basins", as follows:

Far East Basin (Dalryba) with headquarters at Vladivostok;
Northern Basin (Sevryba) with headquarters at Murmansk;
Azov and Black Sea Basin (Azcherryba) with headquarters at Yalta;
Caspian Sea (Caspryba) with headquarters at Astrakhan;
Western Basin (Zapryba) with headquarters at Riga.

Each Basin is organized in operational divisions, responsible for specialized functions such as production, processing and inspection.

Organization of the All-Union Scientific Research Institute of Marine Fisheries and Oceanography (VNIRO)

Research to complement the massive and still expanding Soviet fishing effort in the oceans and seas of the world, in the technology of fish handling and processing, and in oceanography and allied disciplines, is conducted by VNIRO in Moscow, and its associate institutes. These are as follows:

1. Polar Research Institute on Fisheries and Oceanography (PNIRO) at Murmansk
   - the area of responsibility includes the Barents Sea, North Sea and other Atlantic waters of the northern hemisphere.

2. Atlantic Research Institute on Fisheries and Oceanography (ATLANTNIRO) at Kaliningrad
   - responsible for the waters of the North and Central Atlantic.

3. Pacific Research Institute of Fisheries and Oceanography (TNIRO) at Vladivostok
   - has five branches and is responsible for the Pacific Ocean.

4. Azov and Black Sea Research Institute of Marine Fisheries and Oceanography (AZCHERNIRO) at Kerch
   - responsible for research in the Indian Ocean and the South Atlantic Ocean.

5. Azov Fisheries Research Institute (AZNIRO) at Rostov
   - responsible only for the fish stocks of the Sea of Azov and the Black Sea.

6. Caspian Research Institute of Marine Fisheries and Oceanography (CASPNIRO) at Astrakhan
   - with its three branches is responsible for the Caspian Basin and the Volga river.

7. Baltic Research Institute of Marine Fisheries and Oceanography (BALTNIRO) at Riga.

8. Scientific Research Institute of the Mechanization of the Fish Industry (NIIMRP) at Leningrad
   - responsible for research on the mechanization and development of equipment for fish catching and processing.

Administratively, they all depend on the All-Union Ministry of Fisheries and its five regional management units or basins.

VNIRO has special responsibility for the activities of the fisheries research institutes outside of Moscow. It plans and programs all research projects and co-ordinates the work of the institutes to avoid duplication. It evaluates and consolidates all institute reports for transmission to the Ministry of Fisheries. In addition to meetings which are held with each institute, VNIRO convenes twice-yearly meetings at which all institutes are represented.

VNIRO carries out its own research programs in 25 laboratories and sections in Moscow, including work in fishery technology and processing. It has a staff of 550, 60 percent of whom are women. It operates a research vessel, the Knipovich, which has 16 laboratories. In these, experimental supporting work is done on fish processing, fish meal manufacture, and the testing of new processing equipment. It is also equipped with a large analytical laboratory.

The 200,000-volume library at VNIRO is the third largest of its kind in the world. Information is exchanged regularly with over 200 foreign institutions.

VNIRO consults with other research institutes, such as the University of Moscow, the Veterinary Research Institute, and the Institute of Canning and Freezing, the Food Institute of the Academy of Sciences of the U.S.S.R., etc. In some instances, it enters into special agreements with those agencies and gives contracts for research and development work on fishery problems.

Scientists from VNIRO almost always accompany the Soviet fishing fleets to the oceans and seas of the world, where the fishery resources are harvested.

An interesting responsibility of VNIRO is the standardization of fish products. Draft standards are developed, discussed with industry and with the Ministries of Fisheries, Trade and Health, respectively. The final draft standards are then submitted to the State Council of Ministers where further amendments may be made before they are published as a GOST standard, and become law.

## Organization of fishery industries

The Soviet fisheries are based on the activities of (1) state organizations and (2) co-operatives, which pursue a common goal, i.e., to fulfill the state plan for the catching and utilization of fish.

The leading role in fisheries is played by the state organizations, which account for two thirds of the total catch and almost all of the processed fish products. They control the state fishing fleets and the fish processing combines (KOMBINAT). The latter are large organizations which are comprised in general the fishing harbour with the necessary facilities such as freezing plants and cold stores, fish processing plants, shipyards, gear factories and packing and can-making plants.

The co-operative organizations or "collective farms" (KOLKHOZ), on the other hand, are voluntary unions of part or full-time fishermen. The means of production and general supplies are acquired from the state supply organizations, in accordance with the plan of supplies for the whole fishery industry, on an instalment basis and at the same price as state organizations. They fish free-of-charge, primarily in the grounds allotted to them in inland or coastal waters, but also by special licence along with the state operated vessels on the high seas. These collective fishery farms provide nearly one third of the total Soviet catch. Their landings are usually delivered either to the state processing combine with which they are under contract or to the state floating bases or refrigerated carriers to which the state fishing and processing fleet delivers. Supplies of salt, ice, packaging materials, etc., are made by the combines and by the state floating bases on the high seas.

Some of the collective farms have their own fish processing plants, mainly for smoking and salt curing, which require neither large investment nor complex machinery. The collective farms very often fish on a part-time basis only. Their revenue is accrued from fishing operations - they retain a pre-fixed percentage (up to 25 percent) of the price of the fish delivered or fish products. Profits are normally re-invested in new equipment, rather than distributed directly to the members of the co-operative. However, each collective farm does have a bonus fund, derived from a standard deduction of up to 2 percent of the profits, which acts as an incentive to workers.

The fish products made by the state fish processing combines and by the processing plants of the co-operatives are delivered to the wholesale organizations of the Ministry of Trade, in accordance with pre-established plans for distribution to the retail network or, where necessary, for further processing. These wholesale organizations, in turn, have their own processing combines at the large consumption centers, e.g., Moscow, in which the final fish products are prepared from the semi-processed material supplied by the state enterprises.

Organization of fish inspection

In the U.S.S.R. each of the Ministries of Fisheries, Health and Trade, has some degree of responsibility for the inspection of fish, fish products and processing plants.

Responsibility for the sanitation of all food plants rests with the Ministry of Health. Doctors are employed to maintain the required controls over environmental hygiene and to develop programs of health education for plant workers, particularly where bacteria of public health significance are found on foods produced in any factory.

The Ministry of Trade has the responsibility for the inspection of all foods prepared, stored and distributed for human consumption. The right to issue certificates and to inspect and reject finished food products rests solely with the Ministry of Trade.

In general, the Ministry of Trade exercises its responsibility for inspection of all goods in three ways:

1. Inspection as a result of consumer complaints. This, by far, is the most extensive and common type of inspection.

2. Sporadic or spot-check inspection in retail stores, restaurants, and mass-feeding institutions.

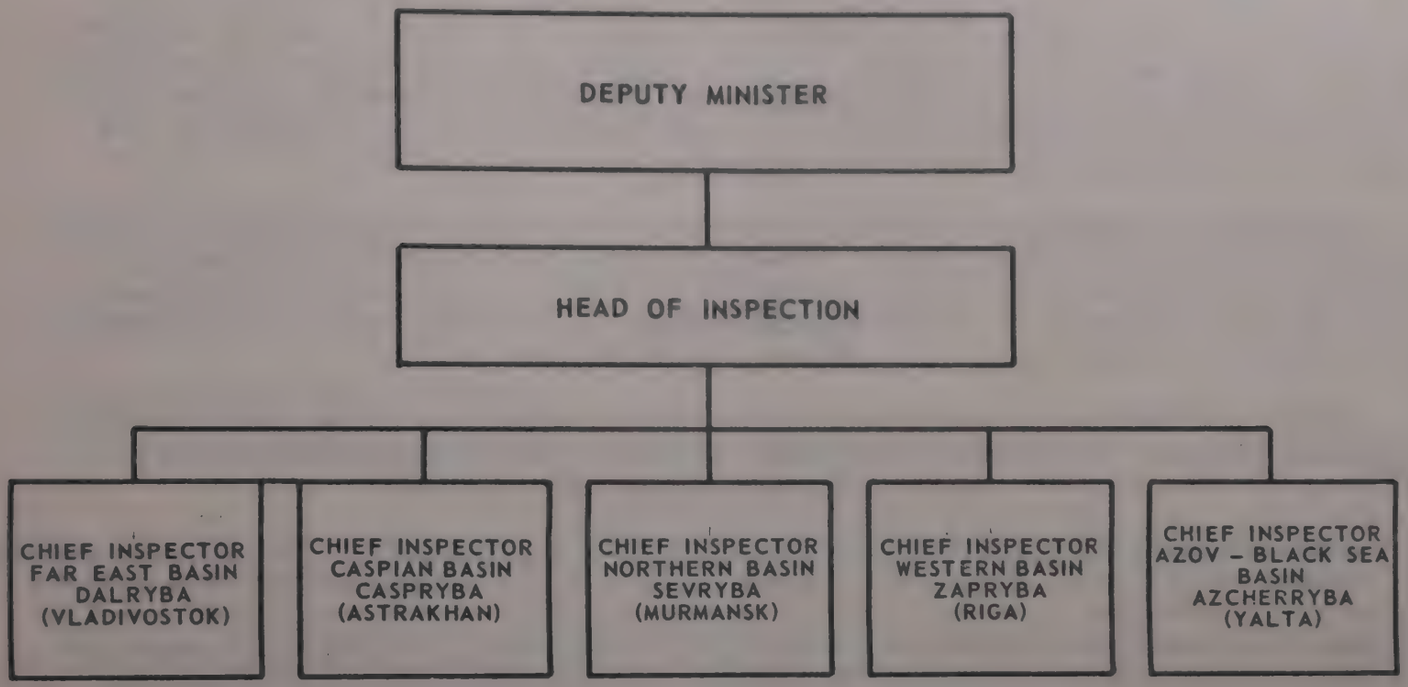
3. Spot-check inspections in processing plants. In the case of fisheries, surprise inspections additionally may be made from one to five times annually of vessels which process fish at sea.

The responsibility for inspecting all fish caught and landed in the U.S.S.R. rests with the Ministry of Fisheries. This includes, if necessary, continuous inspection at the factory ship and processing plant level, but not beyond. At the present time, some degree of inspection is given to 90 percent of fish landings. A Department of Inspection forms part of the Ministry (see Fig. 1).

All-Union State Standards (GOST) exist for fish and fish products, and only these specifications may be used by industry and by the Ministries of Trade and of Fisheries in determining quality. The standards are developed initially by VNIRO, and officially adopted only after they have been reviewed by industry and the various government agencies.

Each processing plant has an Office of Technical Control, which is responsible for the quality of all fish products from the factory, and which applies industrial inspection. It maintains a laboratory in each factory in which bacteriological and other types of routine analyses are carried out.

MINISTRY OF FISHERIES
DEPARTMENT OF INSPECTION - ORGANIZATION CHART


DEPUTY MINISTER
HEAD OF INSPECTION
CHIEF INSPECTOR FAR EAST BASIN DALRYBA (VLADIVOSTOK)
CHIEF INSPECTOR CASPIAN BASIN CASPRYBA (ASTRAKHAN)
CHIEF INSPECTOR NORTHERN BASIN SEVRYBA (MURMANSK)
CHIEF INSPECTOR WESTERN BASIN ZAPRYBA (RIGA)
CHIEF INSPECTOR AZOV - BLACK SEA BASIN AZCHERRYBA (YALTA)

AN EXAMPLE OF A BASIN ORGANIZATION

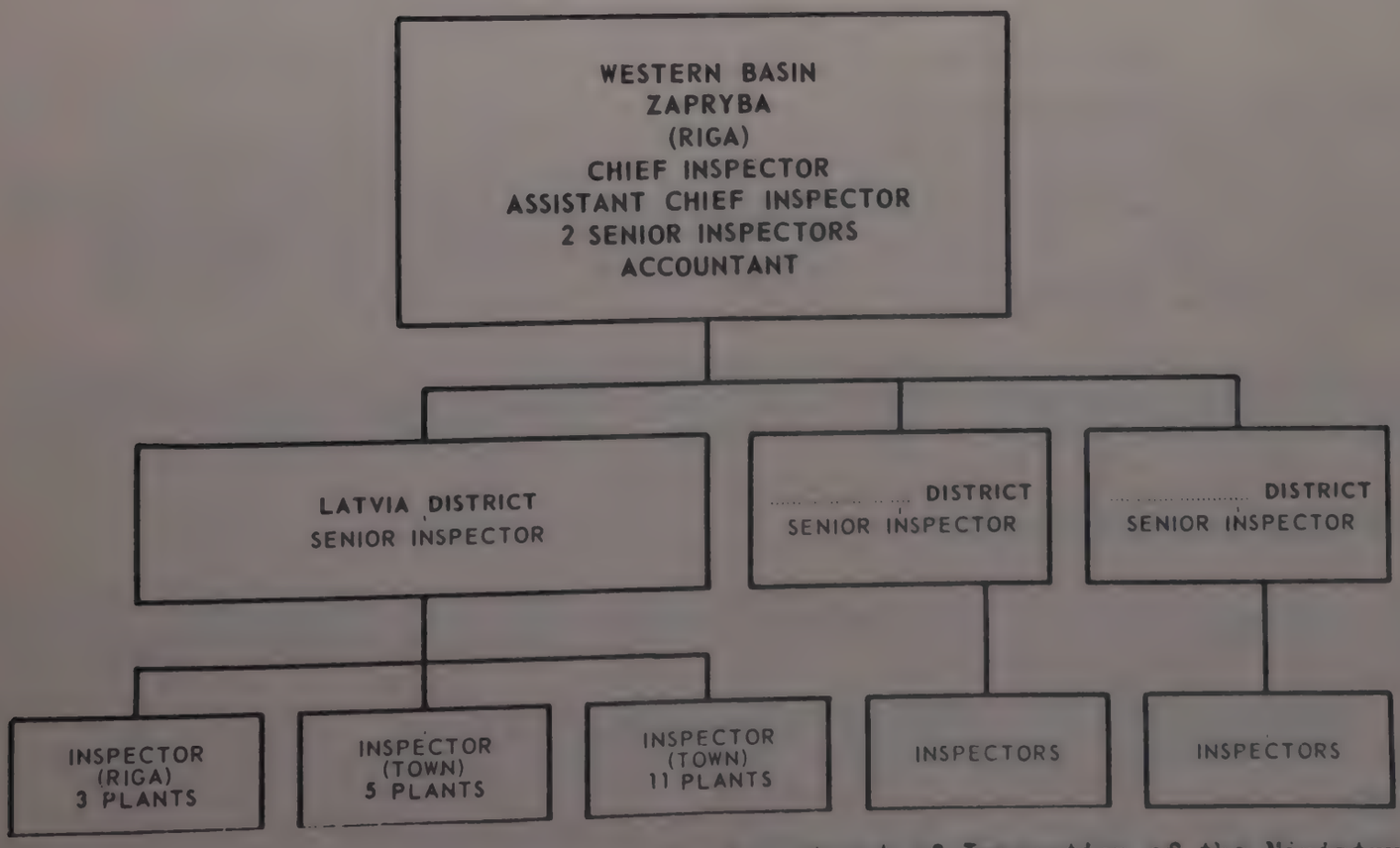



Figure 1. Organizational chart of the Department of Inspection of the Ministry of Fisheries.

In a sense, the Inspection Service of the Ministry of Fisheries checks the efficiency of the Office of Technical Control. The Chief Inspector in a factory has the right to order the prohibition of the processing of unsatisfactory raw material, to order changes in processing procedures and methods, and to require alterations in handling practices. If the supervisor of a section of a factory where a problem is found does not follow the official instructions of the Chief Inspector, a report will be made by the Chief Inspector to the Director of the factory, who is expected to take the necessary corrective action.

The Chief Inspector of the Basin endeavours to settle differences of opinion on quality matters which may arise between a Chief Inspector and the factory Director. If the dispute cannot be resolved at this level, it is referred to the Chief of the Department of Inspection in Moscow. An appeal against his decision may be made to the Minister of Fisheries, whose ruling is final.

Although the director of a factory has full jurisdiction over the Office of Technical Control, he is not responsible for any inspection staff from the Ministry of Fisheries who may be assigned to his establishment.

The personnel of the Department of Inspection numbers 130. The largest office is located in Murmansk, where 17 officers are posted. All inspectors are either university graduates or have technical school diplomas. Fish inspection laboratories are not operated by the Ministry. Instead, the Inspector uses the facilities of the laboratories of the Office of Technical Control or the local laboratory of the Department of Health, should the Department of Inspection wish to check the bacteriological quality of any fish or fish products.

## 4. FISH PROCESSING METHODS AS OBSERVED IN THE U.S.S.R.

### MURMANSK

#### Description of the Northern Basin

The massive operations of the Soviet fisheries in the North West Atlantic, and in the Arctic seas, are centered in Murmansk, a city nearly 300 kilometers north of the Arctic Circle. In 1966, over 1¼ million metric tons of fish, or more than 20 percent of the total Soviet catch, were landed, making Murmansk the largest fishing port in the world.

It is also the headquarters of the Northern Basin of the Ministry of Fisheries, which includes not only the various functional and administrative departments, but also the Polar Research Institute on Fisheries and Oceanography (PNIRO) (see Fig. 2.)

#### Fish catching and transport

A large fleet of floating factories, freezer trawlers, and so-called "motherships" use Murmansk as its base. The members of the Study Tour had an opportunity to visit the following types of vessels:

1. Murmansk – This is a 3,500 ton stern trawler and freezer.

Specifications:

(a) total crew numbers 92, of whom 50 are employed as fish processors and work in shifts;

(b) two blast freezers, each of which has two chambers, ranging from - 35°C to - 38°C; there are no vertical or horizontal plate freezers;

(c) freezing capacity: 45 tons/24 hours;

(d) freezing rate: 4 hours for a 12-kilogram block of cod fillets, and 6 for an 11-kilogram block of round herring;

(e) cold storage temperatures: -18°C to -20°C;

(f) refrigerant: ammonia;

(g) processing equipment: 3 vertical water-cooled retorts
1 can seamer, Lubeck 210
1 each of Baader Nos. 46, 47, 99, 150, 238 and 666 washing, filleting and skinning machines, aluminum freezer pans;

(h) processing procedure: codlike fishes less than 50 centimeters in length, redfish and whole herring are frozen. The objective is to produce as much as possible in fillet form and thus the largest cods are so processed. Small quantities of herring are canned. The time lapse from the moment the fish arrives on deck until it is processed is 3 to 4 hours for frozen fish, and 4 to 5 hours for canned fish. Processed fish are transferred from time to time to a "mother ship" or transport vessel by means of a crane. Cod livers are processed into liver oil. All frozen whole fish are glazed in fresh water before packing;

(i) cannery capacity: 1,200 x 350-gram or 420-gram cans daily;

(j) fish meal plant capacity: 7 tons of fish waste daily by dry reduction, 5-hour process. Meal is pelletized hydraulically in cylindrical blocks;

(k) storage capacity: 700 tons of frozen fish
120 tons of fish meal
60 tons of fish oil
50,000 x 350-gram cans of herring;

(l) general: the Murmansk stays at sea an average of four months and lands 6,000 tons of fish products annually. Midwater and bottom trawls are used for herring and bottom trawls for cod. With stablizing equipment, vessels can fish in winds up to Force 9, and can process fish in any weather. The captain is paid 800 roubles[1] monthly, while a crow member receives from 200 to 250 roubles monthly. The vessel cost 1,700,000 roubles to construct and equip.

2. Sevryba - 10,000-ton storage and processing vessel.

Specifications:

(a) crew: 260, of whom 120 are employed in shifts as fish processors;

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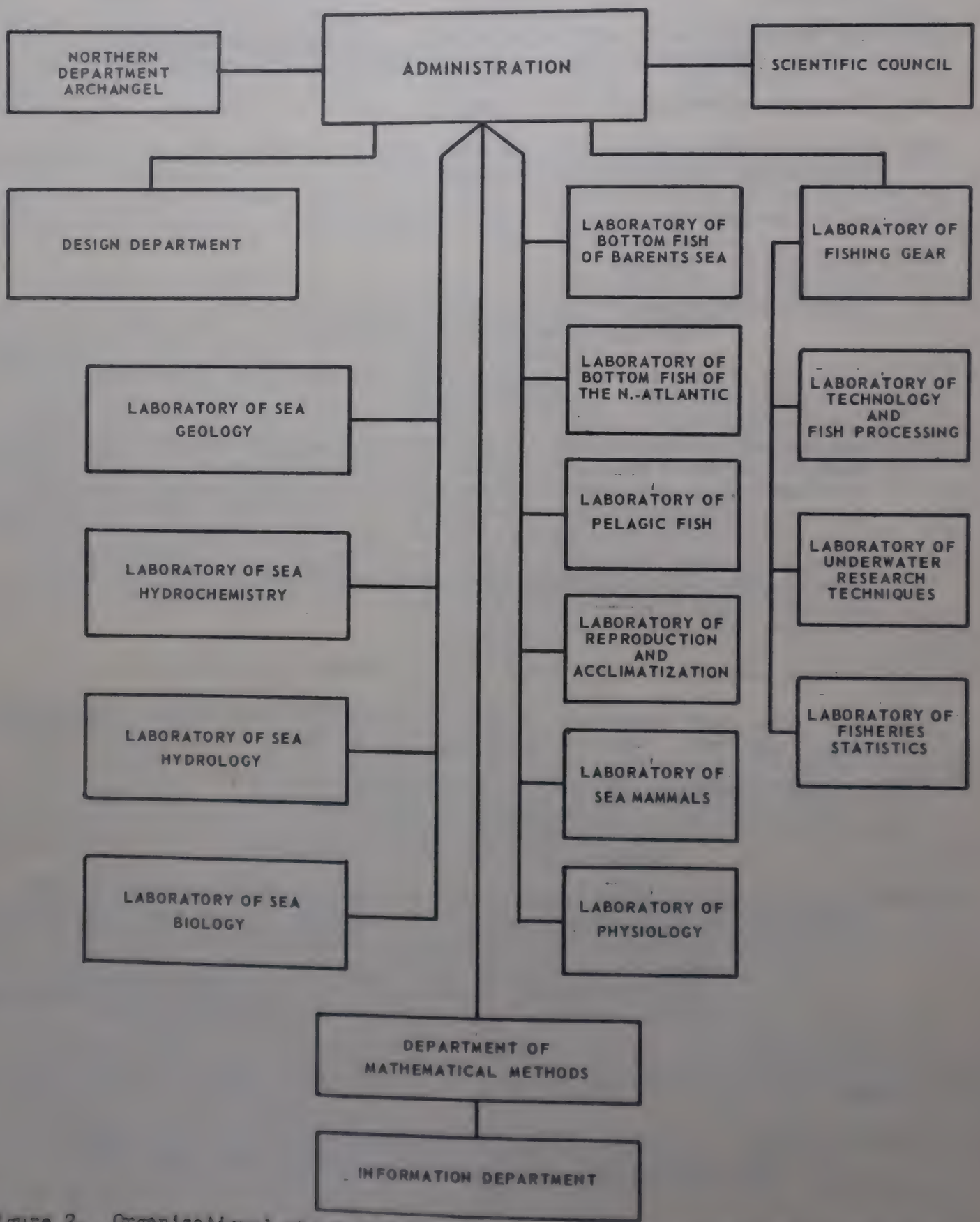
1/ 1 rouble equals US$ 1.10

POLAR RESEARCH INSTITUTE ON FISHERIES AND OCEANOGRAPHY (PNIRO)
MURMANSK


NORTHERN DEPARTMENT ARCHANGEL
ADMINISTRATION
SCIENTIFIC COUNCIL
DESIGN DEPARTMENT
LABORATORY OF BOTTOM FISH OF BARENTS SEA
LABORATORY OF FISHING GEAR
LABORATORY OF SEA GEOLOGY
LABORATORY OF BOTTOM FISH OF THE N.-ATLANTIC
LABORATORY OF TECHNOLOGY AND FISH PROCESSING
LABORATORY OF SEA HYDROCHEMISTRY
LABORATORY OF PELAGIC FISH
LABORATORY OF UNDERWATER RESEARCH TECHNIQUES
LABORATORY OF SEA HYDROLOGY
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LABORATORY OF FISHERIES STATISTICS
LABORATORY OF SEA BIOLOGY
LABORATORY OF SEA MAMMALS
LABORATORY OF PHYSIOLOGY
DEPARTMENT OF MATHEMATICAL METHODS
INFORMATION DEPARTMENT

Figure 2. Organizational chart of the Polar Research Institute of Fisheries and Oceanography (PNIRO).

(b) cold storages; frozen fish are stored at -18°C, while mild salted and semipreserved fish products such as herring in brine, are held at -5°C;

(c) refrigerant: ammonia. The compressors have a capacity of 1,200,000 kcal;

(d) storage capacity: 4,500 tons of frozen fish
700 tons of fish meal
200 tons of fish oil
200,000 cans of herring;

(e) fish meal plant capacity: 50 tons of fish waste daily on two lines by the wet reduction method: stickwater is recovered. Fish meal is packed in 30-kilogram 4-ply paper bags.

(f) processing facilities and procedures: one line for processing mild salted herring, which are delivered partly cured from trawlers. The salted herring are washed in a squirrel cage type washer and scaled, sorted, graded and either placed into barrels which are filled with brine and stored at -5°C, or dry packed in 40-kilogram wooden boxes and stored under refrigeration. There is one canning line for unsterilized semipreserved fish packed in 3-kilogram cans and stored at -5°C.

(g) general: The Sevryba supplies the trawlers with fresh water and carries a maximum supply of 1900 tons. The vessel stays at sea an average of three months, and handled 12,000 tons of fish products in 1966. It is equipped with a quality control and inspection laboratory under the supervision of a technologist. The vessel cost 6,500,000 roubles fully equipped, and there are nine of its kind in the U.S.S.R.

Fish processing

Visits were made to the Murmansk Fish Processing Combine where raw and semi-processed fish, delivered by trawlers and other vessels, are manufactured into various forms of fish products. The combine includes a salt fish plant, filleting plant, smoked fish plant, new products laboratory, fish meal plant and a barrel and box factory.

Salting Whole dogfish, skate, ocean perch, cod, haddock and other species are salted aboard the factory trawlers and have a salt content of approximately 5 percent when delivered to the plant. The fish are washed, sorted into species and packed into barrels with a capacity of 150- or 250-kilogram net weight.

The empty barrel is fitted with a 15-centimeter false metal rim and placed on a mechanical vibrator. Layers of fish and salt are packed alternately so that a salt content of 8 to 10 percent is reached in the final product.

The overfilled barrel is carried by conveyors to a pressing machine and a weighing scale. Finally, the top is clamped on mechanically and either shipped immediately or placed in refrigerated storage.

Filleting and freezing Prior to processing, fresh fish are held in ice in aluminum boxes or are piled on pallets to a depth of four feet or more and heavily iced. Fish are always washed at sea before being stored in ice. Fresh fish delivered to a plant must be processed within two hours or must be iced immediately. They may be kept for no longer than two days in ice.

The fish are carried by white rubber conveyor belts to the metal processing tables. Fish are filleted by hand, although skinning and other auxiliary operations are done with Baader 38, 46, 47 and 99 equipment. The yield on cod by hand filleting is 40 to 42 percent; about 28 percent recovery is realized on sole. The skeletons and other offal are flumed in fresh water to the reduction plant.

Small cod and other species are also headed and gutted by hand and frozen. The blood is carefully brushed and scraped from the backbones of fish so processed.

Metal tables and utensils were in use throughout the plant. The utensils had riveted rather than tight seams.

Fresh fillets are packed in parchment paper in four-kilogram blocks. Three such blocks are placed on metal trays and fast frozen.

Special products In a room adjacent to the filleting area, a product similar to ravioli and called "pelmeni" is produced. Skinless fresh fillets are forced through grinders with 10-millimeter holes. The minced fish are mixed with vegetable oil, onion, butter and spices and extruded in a continuous rod, one inch in diameter, which is enclosed within a wheat flour batter. The rod passes under a wheellike cutter which gives the ravioli-shape to the product (see Fig. 3). After packaging, the product is frozen and sold to hotels and restaurants.

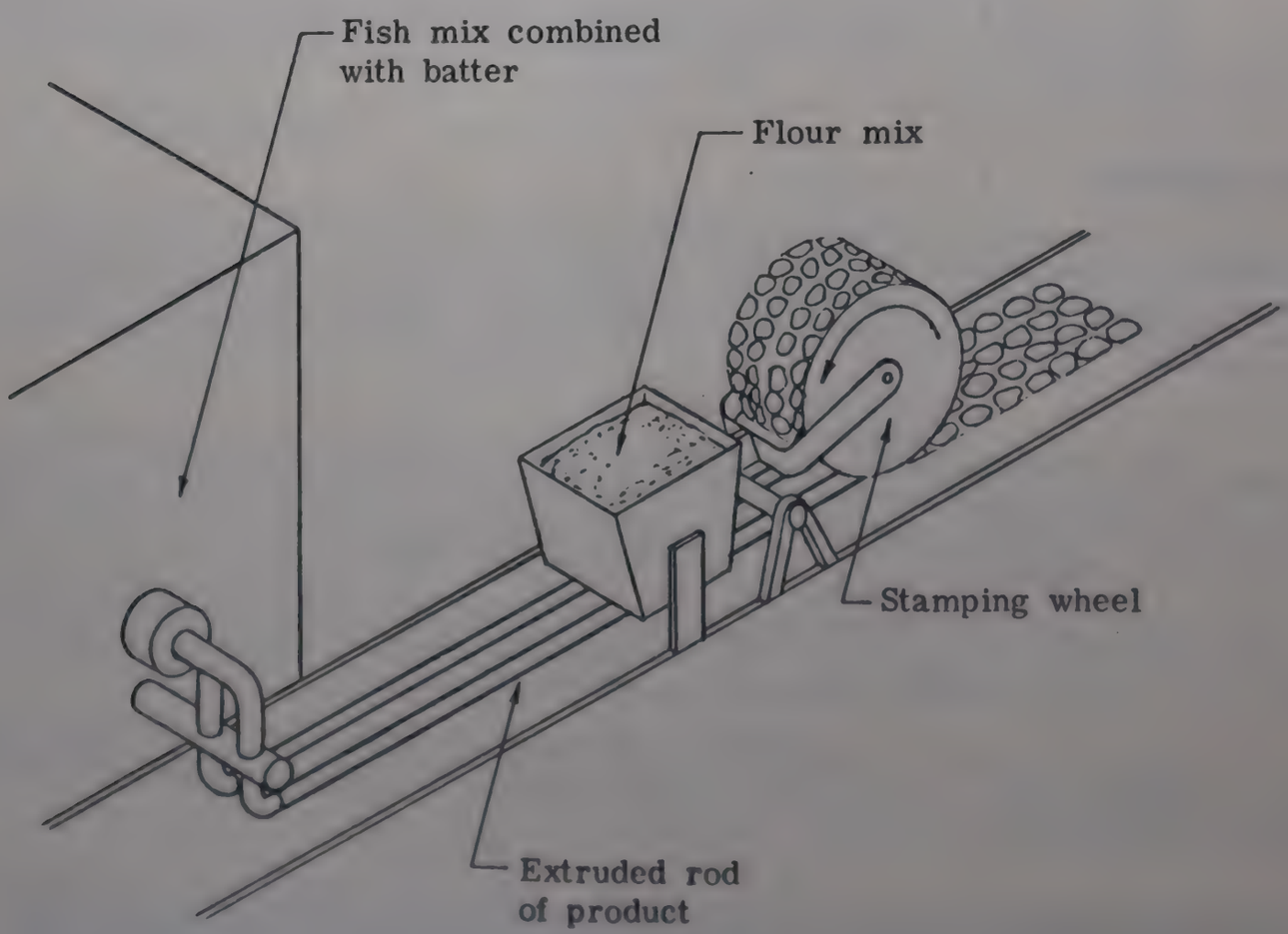



Figure 3. Equipment to make fish pelmeni.

The formula for 100 kilograms of the final product is:

| | | | | |
|---|---|---|---|---|
| Paste | Minced fresh fillets | 45.1 kg | Butter | 1.7 kg |
| | Sunflower oil | 4.3 kg | Salt | 1.6 kg |
| | Onions | 2.0 kg | Pepper | 0.1 kg |

Ingredients are well blended in a mixing vat and the paste is placed in a hopper which feeds the extruder.

Batter

| | |
|---|---|
| Wheat flour | 36.4 kg |
| Sugar | 0.1 kg |
| Water | 8.7 kg |

The batter is prepared in a bowl equipped with a warming jacket.

Smoked fish. Among the species smoked are cod, haddock, ocean perch, halibut, hake etc.

1. Hot smoke. Fish are dipped in brine until a salt content of 3.5 percent is reached, then tied with cord as illustrated in Figure 4 for hanging on the rack hooks of the continuous chain conveyor. The hot smoke tunnel is 10 meters long, but the conveyor system within the tunnel travels 355 meters and four different speeds may be used.

Figure 4. Preparation for hot smoking.

The total time elapsed for hot smoking is four hours but only one hour is spent for cooking and smoking. The balance of the cycle is used for heating and cooling.

Depending upon the size of the fish, temperatures from 80°C to 200°C are used. Heat and smoke are generated from a fire of birch logs covered with birch sawdust. The fish are protected from dripping tar and other undesirable residues by a gutter on each rack.

2. Cold smoke. The fish are brined to a salt content of from 5 to 12 percent depending upon size and species. After tying and hanging in a huge horizontal smokehouse, a period of drying of from 5 to 10 hours at 20°C to 25°C is first given. Smoking is done at temperatures of from 28°C to 35°C for periods ranging from 45 to 65 hours, again according to the size of the fish.

3. Special smoked products and packaging. Halibut are fist fletched and portioned into 1 to 2-kilogram pieces. These are soaked in a heavily spiced mild brine, then rolled and tied for hot smoking.

With sole, the dorsal side is removed, then it is spiced, rolled and hot smoked. The other side of the unboned sole is cold smoked. Smoked fish are packed in

parchment-lined wooden boxes containing 23 kilograms each. Each month, the plant produces 160 tons of cold-smoked fish and 250 tons of the hot smoked product.

Fish meal and oil

Three processing lines of Atlas and Alfa-Laval equipment can handle 180 tons of salted and fresh fish wastes daily. Each ton of salted fish waste yields 380 kilograms of fish meal and from 450 to 500 kilograms of meal are recovered from each ton of fresh material.

Salted raw material is soaked in fresh water then mixed with fresh waste in a 1:6 ratio. Stickwater is concentrated in evaporators and added to the presscake to produce whole fish meal. The meal is packed in 30-kilogram four-ply paper bags or in 50-kilogram jute bags.

Barrel and box manufacture

Barrels are made of pine or fir in 50-, 120-, 150-, and 250-kilogram sizes. About 15,000 barrels are produced monthly to supply not only the fish-processing complex at Murmansk, but also the fishing vessels operating out of that port. A 120-kilogram barrel costs 4 roubles 9 kopecks.

The wood used in barrels for domestic trade has a moisture content of 17 to 18 percent but, for export barrels, not more than 14 percent moisture is allowed.

A separate factory, 70 kilometers from Murmansk, specializes in the recovery of used barrels. They are first repaired and then washed with alkaline solution and sprayed inside with resin and paraffin wax mixture. All new pine barrels are also sprayed with this solution to prevent the absorption of undesirable flavors by the fish.

The large factory also produces wooden boxes and corrugated cartons. The operations are highly mechanized and almost all the employees are women.

Research

Fishery research in all areas of the North Atlantic and the Barents Sea is carried out by the Polar Research Institute on Fisheries and Oceanography (PNIRO) and its branch in Archangel. PNIRO is mainly engaged in work in the fields of marine biology, fishery technology and scientific management of fisheries, as indicated in its organizational chart (see Fig. 1).

General Observation

The labor input per unit of production is high with the possible exception of the barrel factory visited.

Quality control

The Ministry of Fisheries has a Department of Fish Inspection which has a branch in Murmansk with a staff of 17.

The processing plant has an Office of Technical Control which is responsible for the quality of all products and which reports to the manager of the plant. It has a small laboratory that maintains a bacteriological check on equipment, tables and other facilities in the factory and on the holds of fishing vessels which

are disinfected after the cargo is unloaded. Persons with sore throats, sores, cuts and boils are not permitted on the processing line.

The inspector has the right to prohibit the processing of unsatisfactory raw material. A statement of deficiencies is issued for any unqualified product and the processor is advised. The fish inspectors provide line organoleptic inspection and often go to sea to check on icing, stowing, washing and other handling practices.

No fish inspection procedures were observed during the unloading process or in the processing plants. Inspection seems to be confined to the final product.

Inspectors are not carried on board factoryships as members of the crew and there appears to be little or no inspection of the raw material at this stage of handling. There is no bacteriological check on fresh fillets as an index of plant sanitation but swabs are taken from time to time of different working areas in the plant. The Office of Technical Control in the Murmansk Fish Processing Combine has a total staff of 32.

## ASTRAKHAN

### Description of the Caspian Basin

The Caspian Basin is the source of the oldest commercial fishery in the U.S.S.R. and produces nearly one million metric tons of fish annually, not only from the Caspian Sea but also from the Volga, the Don and other rivers which flow into it. The major species taken are sturgeon, herring, kilka (Clupeonella delicatula caspia), pike, pickerel and suckers.

The Ministry of Fisheries has the administrative offices in Astrakhan for the Caspian Basin (CASPRYBA) as well as fish processing facilities, several training schools for fishermen and plant workers. CASPNIRO, the oldest fishery research institute in the U.S.S.R., is also located here.

Through evaporation and reduced drainage, the level of the Caspian Sea has fallen over eight feet in the past 40 years and fish stocks are decreasing. The waters of the northern section of the Caspian Sea are slightly brackish while those of the southern portion are saline. Some investigators claim that there has been a marked increase in the salinity of the southern Caspian, but this is denied by Soviet scientists.

### Fish catching, handling and transport

Several types of both steel and wooden boats fish in the Caspian Region. Members of the Study Tour saw small wooden vessels ranging from 10 to 15 meters in length, which operate with gillnets to catch pike, pickerel, sturgeon and other freshwater species. The holds of these vessels are not shelved and ice is neither carefully nor adequately used. Small round wood-burning stoves are carried on deck for boiling pots of tea and soup.

Fresh sturgeon, unloaded at Astrakhan from these vessels, are hooked with a pugh through the gill flaps or the belly flaps and thrown into a large (200 kg) iron box. This is then liften by crane to the receiving room where the fish are hosed

with chlorinated water before being transported to the freezing plant. It was noted that all other species of fish are landed ungutted.

The following type of kilka freezer trawler was visited:

1. Saratov. This is a 960-ton fish pumper and freezer.

Specifications:

(a) crew: 32;

(b) motive power: 2,600 hp diesel;

(c) speed: 11 knots;

(d) length: 56 meters;

(e) freezing equipment: 3 DAO 50 compressors and blast freezers at -39°C;

(f) freezing capacity: 150,000 kcal.

(g) freezing rate: 2½ hours to freeze an 8-kilogram block of whole kilka to -17°C in the ASMA continuous quick freezer (see Fig. 5);

(h) cold storage: 180 tons ranging from -15°C to -17°C;

(i) general: the vessel fishes only at night to a depth of 100 meters with pump and lights. The cetrifugal pump, an RB 200, is connected to a waterproofed spiral steel hose 20 centimeters in diameter. At a point exactly 12 meters from the pump, a return valve is placed on the hose. Attached to the intake nozzle are two light bulbs each of 1.5 kW, 110 volts AC, to attract the fish. Each bulb costs one rouble and lasts about one month with normal use. The average catch is one ton/hour and the vessel remains at sea for a maximum of two weeks.

(j) cost of vessel and equipment: 1,300,000 roubles;

(k) cost of pump and hose: 20,000 roubles;

(l) there are 18 vessels of this type and all have been constructed in the U.S.S.R.

Fish processing

The oldest and one of the largest fish factory complexes in the country is in Astrakhan and was visited by members of the Study Tour. It was built in 1930 and is now being reconstructed. A total staff of 5,000 is employed of whom 3,100 are on the production line. A full 6-day week is worked with two 7-hour daily shifts.

Each employee works 280 days annually. A 5-day week is being planned for early implementation. Wages are paid on the basis of the skill of the worker and the demands of the job. A bonus is paid if weekly production quotas are exceeded.

There is no compulsory retirement age. However, a woman may voluntarily retire on pension at 55 and a man at 60. The pension is calculated on the average earnings of the last two years of work plus a percentage of total earnings over the best 10 years of employment.

The products of the plant are exported to 12 countries. In 1966, total

production was:

80,000,000 x 350 grams of 27 types of products
20,000 tons of whole frozen ocean fish
500,000 tons of fresh and frozen freshwater fish
4,000 tons of fish meal
400 tons of fish oil

3,000,000,000 International Units of Vitamin A,
100,000,000 empty cans, ranging in size from 50 grams to 3 kilograms

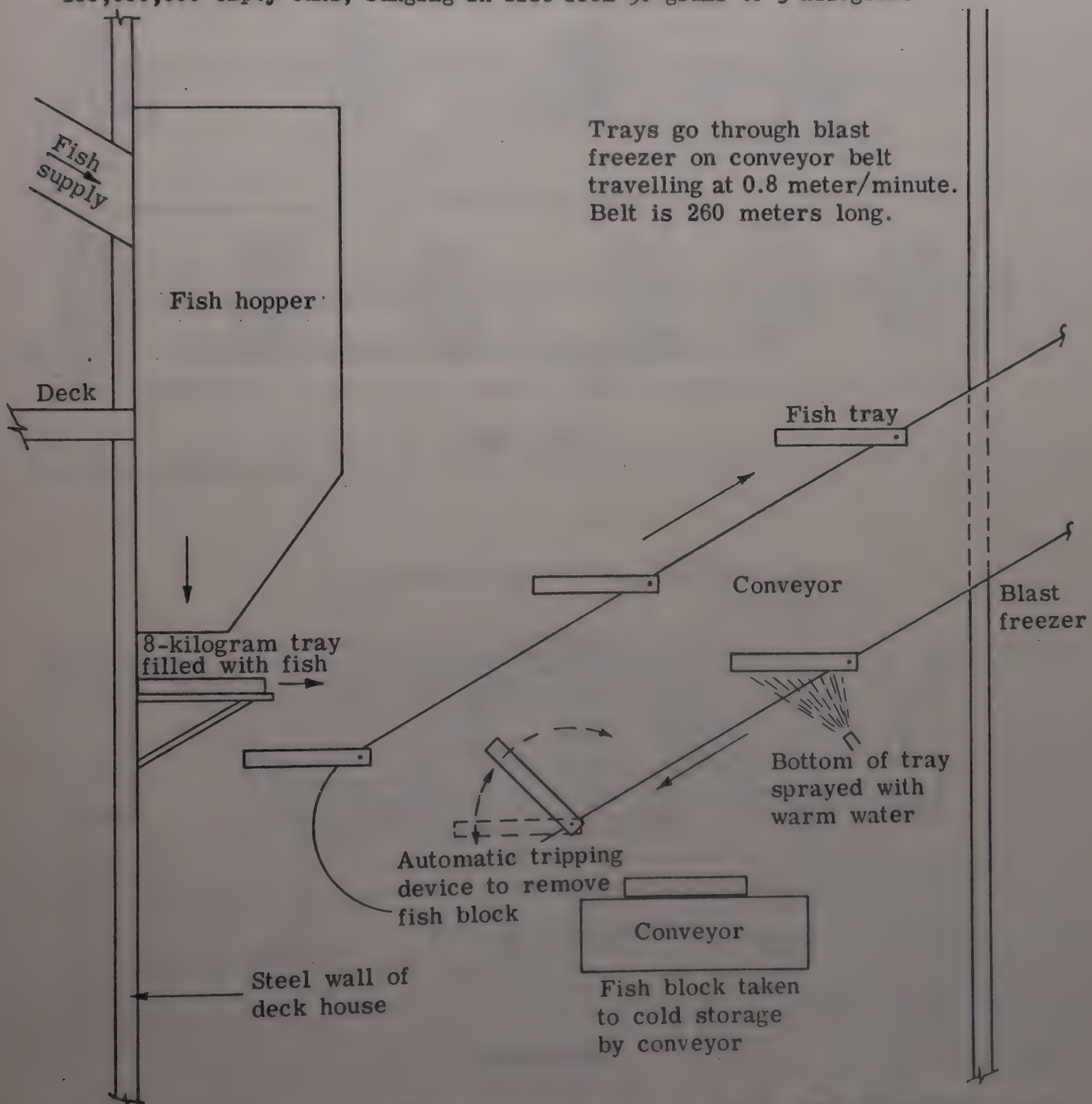
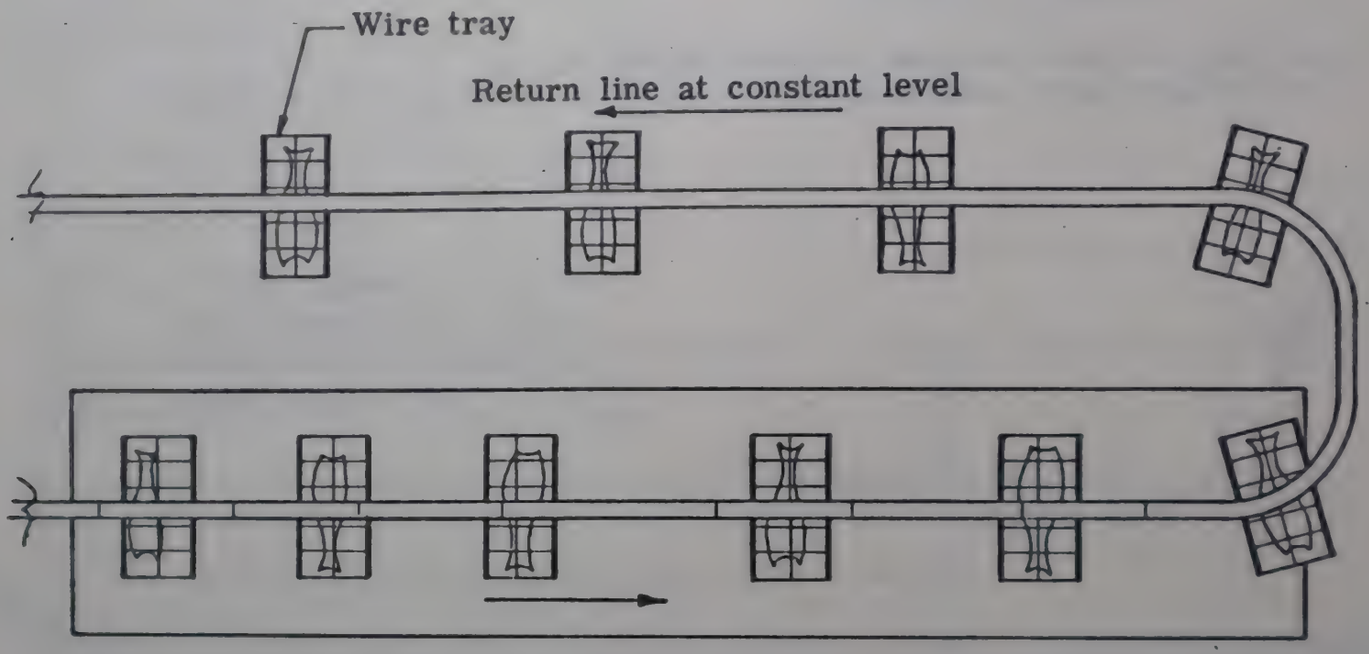
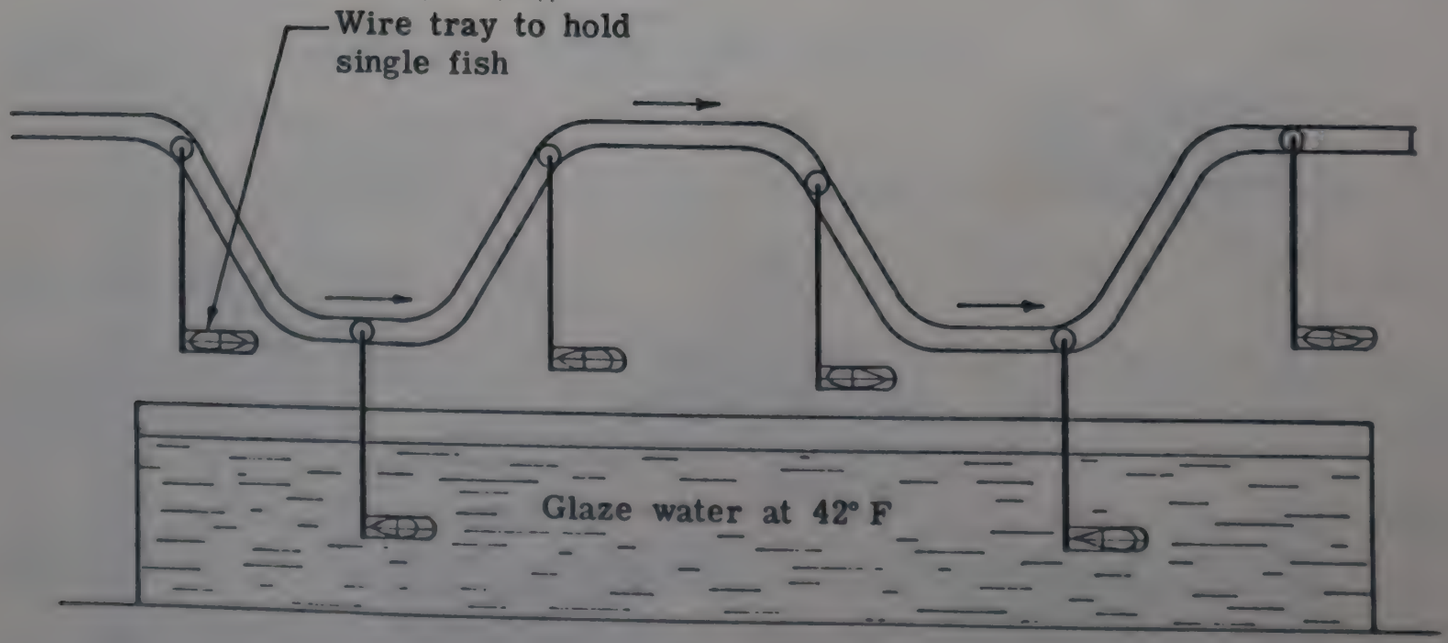

Fish supply
Fish hopper
Deck
Trays go through blast freezer on conveyor belt travelling at 0.8 meter/minute. Belt is 260 meters long.
Fish tray
Conveyor
Blast freezer
8-kilogram tray filled with fish
Bottom of tray sprayed with warm water
Automatic tripping device to remove fish block
Conveyor
Steel wall of deck house
Fish block taken to cold storage by conveyor

Figure 5. Diagram of the charge and discharge systems of the ASMA continuous quick freezer.

Freezing In order to distribute the workload more evenly, kilka and other species of fish to be canned, are frozen and stored for periods of up to nine months at from -18°C to -20°C. Glazing of whole fish is done by an interesting method as shown in Figure 6. Frozen blocks of kilka are packed in cardboard telescopic boxes without any glazing.




PLAN VIEW




ELEVATION

Figure 6. Glazing system for frozen fish.

Thawing is done by water immersion, although experimental work has been carried out on defrosting by infra-red, ultrasonic and dialetric methods (see Fig. 7). None was successful for commercial application.

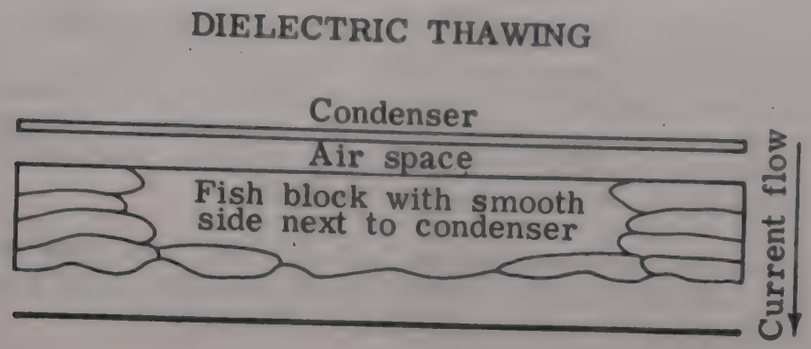



Figure 7. Dialetric method for thawing blocks of frozen kilka.

Resistance thawing (see Fig. 8), seems much more promising.

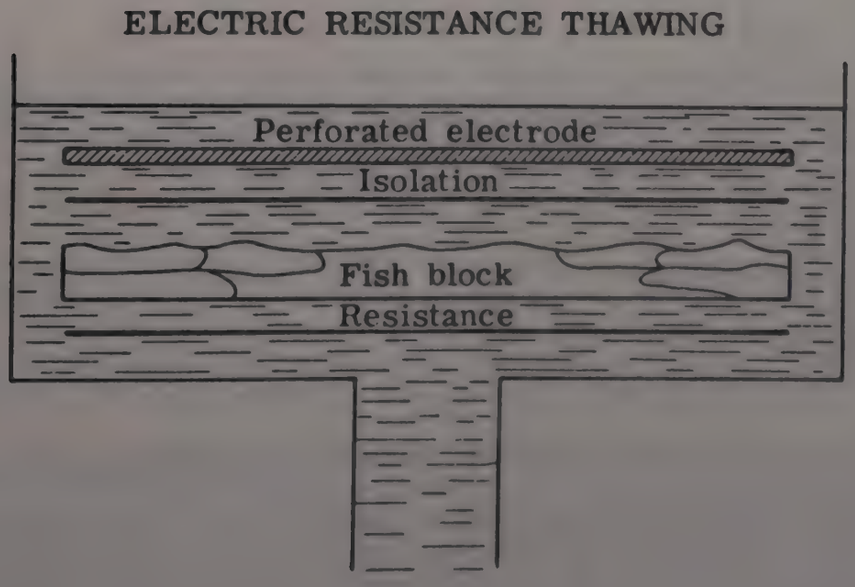



Figure 8. Electric resistance method of thawing blocks of frozen kilka.

Canning. The cannery staff numbers 1,500 and almost all of whom are women. The fish canning industry began in the U.S.S.R. in 1930.

Frozen blocks of kilka are placed on a rack between wire supports and are thawed under a water spray of 10°C. The thawed fish go through a brining tank and over an inspection table where damaged fish are removed. The inspected fish then move to a kilka dressing machine of Soviet design. The machine is hand-fed and circular knives remove heads and tails. Viscera are removed by vacuum.

Approximately 17 different forms of canned kilka are packed. One product requires that the kilka is breaded and cooked before canning. In this operation, the fish travel over 1½-inch diameter metal rollers under the flouring outlet and into a cooking tank of sunflower oil at 150°C for 2 to 3 minutes. They are then packed in cans with vegetable sauce, sealed and placed in 12-foot vertical retorts. There were no automatic weight-control devices in the factory.

Kilka are also canned as sardines in oil and the raw pack procedure is used. The cans travel 15 meters in the cooker and up to 22 percent of the moisture is removed. Smoking for the sardine pack is done electrostatically.

Sturgeon heads are used by the cannery. They are first split with a large mechanical knife, then boiled to remove all meat from the bones. The meat, with spices and broth, is then canned.

Frozen pike, pickerel and other freshwater species for canning are thawed in large tanks filled with water. Thawing takes up to 7 hours. The fish are then dressed, split and filleted by hand on wooden boards.

Fish meal. Kilka and herring, together with offal from canning and other processing operations, are manufactured into fish meal. The approximate percentage analysis of kilka over a 12-month period is:

| | |
|---|---|
| Moisture: | 74.4 - 78.4 |
| Fat: | 1.2 - 6.4 |
| Protein: | 16.6 - 19.0 |
| Ash: | 2.4 - 3.0 |

From such fish, the percentage content of the meal is

| | |
|---|---|
| Protein: | 60 - 65 |
| Oil: | up to 5 |
| Salt: | up to 2 |
| Moisture: | up to 10 |

Special products

1. Caviar

Caviar is 9 to 17 percent fat and 20 to 26 percent protein. When canned, the salt content is from 3.5 to 5 percent, but the lower the salt content, the better the quality. By weight, 1 percent sodium borate ($Na_2B_2O_7$) is used as a preservative. Pasteurization for 3 to 3 3/4 hours at 60°C has been used, but not without toughening the texture of the caviar. Recently, it has been found that the addition of nisin, an antibiotic produced lactic acid bacteria, in amounts of 0.05 - 0.2 percent reduces the pasteurization time to 2 hours and improves the quality, but care should be taken to avoid a bitter flavor.

2. Kilka fish balls in sauce

Members of the Study Tour formed a taste panel to sample a number of canned kilka products. There was general agreement that canned kilka fish balls in sauce was best.

The recipe is as follows; exact weights are quoted.

Fish balls

45.4 kg raw kilka
38.7 kg fried kilka
9.6 kg blanched ground rice
9.4 kg raw onion
14.4 kg fried onion
14.4 kg fried carrots
0.3 kg black pepper
0.2 kg aromatic pepper
2.4 kg parsley
1.2 kg salt

Sauce

11.7 kg onion
17.6 kg carrot
11.7 kg celery
11.7 kg parsley and dill
22.3 kg tomato puree
3.7 kg granulated sugar
12.4 kg vegetable oil
0.213 kg black pepper
0.16 kg aromatic pepper
0.004 kg bay leaves
1.6 kg salt

Mix fish and ingredients together and prepare 20-gram balls. Blanch for 3 minutes in 3 percent salt solution and place in cans with sauce. Recipe is sufficient for 1,000 cans of 250 grams each. The cans are processed for 55 minutes at 115°C.

Research

Technological research at the Caspian Research Institute of Fisheries and Oceanography (CASPNIRO) (see Fig. 9) is of an applied and developmental nature and is directed toward the improvement of the quality of the fish from the raw material to the final product and to the development of new products, new processes and new equipment. Some experimental research results are reported below:

Fish protein concentrate. In 1964, this was produced from kilka by pressing and with the use of two solvents - benzine and ethanol - to remove fat. The final product was gray, very rich in lysine contained 80 percent protein and 0.2 percent fat. Chilled instead of frozen fish gave the best results. Fish protein concentrate (FPC) is not yet produced commercially in the U.S.S.R.

Glazes and protective films. These are various and some are listed below.

1. Herringlike fishes with a fairly high fat content have been used for most experimental work on freezing and refrigerated storage. Lengthy tests and taste-panel evaluation have demonstrated that a solution containing 0.2 percent each of ascorbic acid, citric acid and monosodium glutamate is most effective for glazing kilka frozen and stored at temperatures of from -18°C to -20°C. Fish so treated could be stored for three months longer than those glazed with untreated water.

2. Fish are immersed first in a 6 percent sodium alginate solution, drained for 5 minutes, then dipped in a calcium chloride solution. A protective film of

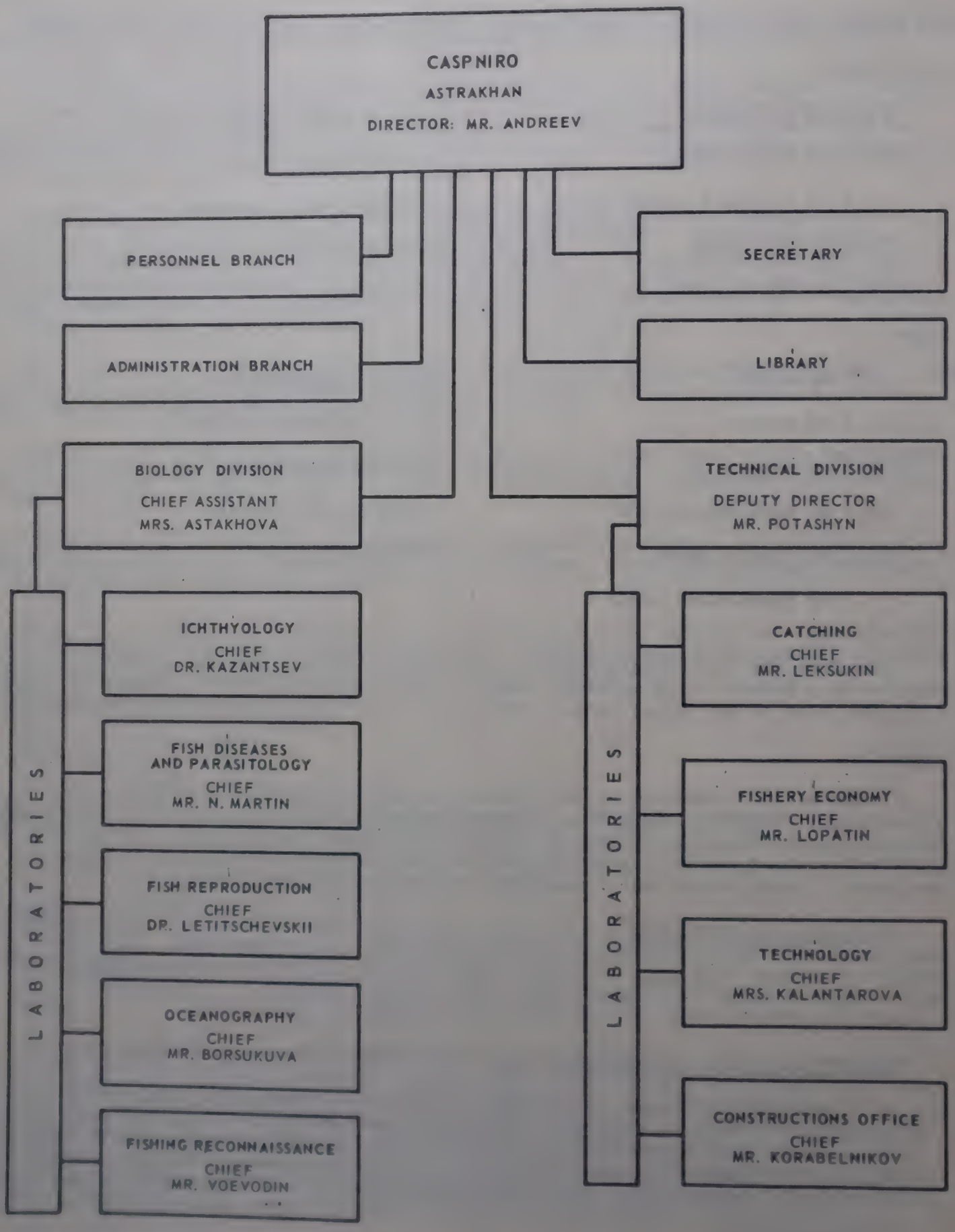



Figure 9. Organizational chart of the Caspian Research Institute of Fisheries and Oceanography (CASPNIRO).

calcium alginate forms over the fish. The film adds approximately 7 percent to the weight of the fish. However, this method is not used commercially as an ordinary hot paraffin dip is as effective and much cheaper.

3. The following data on cold storage keeping time at -18°C was given where quality is measured chemically and by taste panels:

Frozen herring

Glazed with water - 4 months
Glazed with anti-oxidants - 7 months
Alginate film - 6 months

Frozen kilka

Glazed with water - 4 months
Glazed with anti-oxidants - 5 months
Alginate film - 5 months

4. No experimental work has been done with polyphosphates nor has there been any research on the effect on quality of low temperature (-28°C to -32°C) storage.

Fish pumps. While a centrifugal pump for fishing was first developed and is still in use, it is not ideal as up to 25 percent of the fish are damaged by the moving parts of the pump. Pumping from depths nearby 100 meters also results in some broken fish because of the sudden change in pressure.

A much more efficient airlift type of pump has been developed with the following specifications:

Compressor: 22 kW with a capacity of 3 cubic meters/minute

Hose: spiral steel, covered with waterproof material;

length: 100 meters; diameter: 15 centimeters.

Lamps: 2 - 1.5 kW to 3 kW, 110 volts AC each covered with unbreakable plastic (see Fig. 10).

In practice, compressed air is delivered by a small diameter rubber tube to a venturi in the main hose to provide a return mixture of air, water and fish.

Training

The participants toured the Astrakhan Naval and Technical School of Fish Industry, where fishery technologists are trained to the intermediate level, including fish processing. At present 2,500 students are enrolled in the three types of courses offered - day, evening and correspondence - which last from 3 to 4 years and which are given by 96 full-time teachers. Training vessels are at the school's disposal.

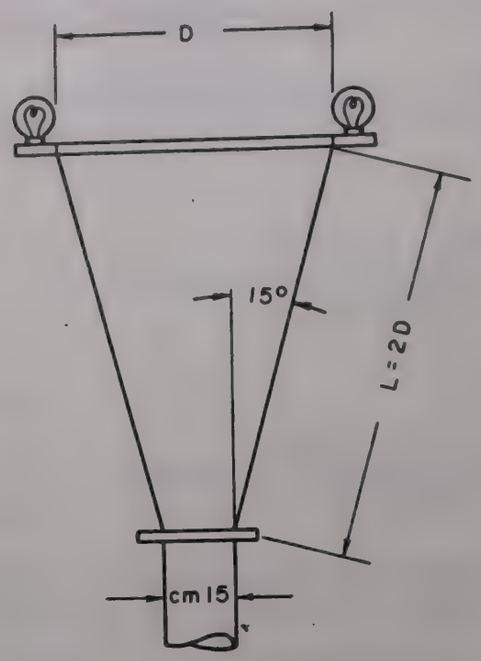



Figure 10. Suction nozzle of the hose of the airlift fish pump.

## 5. COMMENTS AND CONCLUSION

This Seminar/Study Tour was a most positive and rewarding experience for all the participants from the technical aspect of fish utilization and it proved a unique opportunity of seeing a country whose administration, economy and culture were little known to most the members of the group.

The conclusion drawn from this Study Tour was that the trend in the development of the Soviet fisheries is to process as much fish as possible at sea, the emphasis being on the preparation of frozen fish fillets and canned products, and on the automation of the processing operations.

The general consensus among the participants was that the time allotted for visits to processing plants, both aboard vessels and ashore, was usually only sufficient for a general view and did not permit study of details. It appears necessary, therefore, that more time should be provided in future programs for visits to fish handling and processing establishments.

Appendix 1

## PLACES AND PERSONS VISITED IN THE U.S.S.R.

### Moscow

| | | |
|---|---|---|
| Dr. A. S. Bogdanov | Director | All-Union Research Institute for Marine Fisheries and Oceanography,<br>VNIRO,<br>Krasnoselskaya 17,<br>Moscow |
| B. G. Kulikov | Chief | Foreign Department,<br>All-Union Ministry of Fisheries,<br>12 Rozhdestvensky Boulevard,<br>Moscow K-45 |
| P. Javoronkov | Senior Inspector | State Committee for Foreign Economic Relations (GKES),<br>United Nations Branch,<br>Ovtchinikovskaya Nabereznaya 1/18,<br>Moscow |
| Dr. P. A. Moiseev | Deputy Director | VNIRO,<br>Moscow |
| Dr. S. G. Fedorov | Chief | International Fishery Division,<br>VNIRO,<br>Moscow |
| E. B. Gurtavoy | Chief | State Committee on Fishery Seminars,<br>Ministry of Fisheries,<br>Moscow |
| N. I. Rekhina | Chemist | Collaborative Program Textile Research Institute/VNIRO Laboratory of Invertebrates and Seaweeds,<br>Moscow |
| Dr. K. A. Mratchkov | Chief | Laboratory of Fish Oil and Feedingstuff,<br>Moscow (VNIRO) |
| Mrs. (Dr.) R. R. Perepletchik | Senior Research Officer | Laboratory of Fish Oil and Feedingstuff,<br>Moscow (VNIRO) |
| Mrs. (Dr.) F. M. Rzhavskaia | Senior Research Officer | Laboratory of Fish Oil and Feedingstuff,<br>Moscow (VNIRO) |
| Vladimir Tishin | Engineer | VNIRO,<br>Moscow |

### Murmansk

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| Valentin Belikeu | Chief | Technical Department,<br>Northern General Fisheries Department,<br>All-Union Ministry of Fisheries,<br>Murmansk |

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| Sokolovsky | Chief | Processing Section<br>Northern General Fisheries Department,<br>All-Union Ministry of Fisheries,<br>Murmansk |
| S. Rosenberg | Captain | Freezer trawler<br>Northern General Fisheries Department,<br>All-Union Ministry of Fisheries,<br>Murmansk |
| Oleg Bezrukov | Captain | Murmansk freezer trawler (M-244),<br>Murmansk |
| Avenir Smirnov | Captain | Sevryba floating base,<br>Murmansk |
| Mikhail Danilov | Chief | Technical Department<br>Fish Processing Combine,<br>Murmansk |
| Miss F. Lobova | Chief Fish Technologist | Fish Processing Combine,<br>Murmansk |
| George Malyshev | Director | Wood Plant,<br>Fish Processing Combine,<br>Murmansk |
| Miss I. L. Vaganova | Chief Technologist, in charge of smoking plant | Fish Processing Combine,<br>Murmansk |
| D. A. Goldstein | Chief Engineer | Fish meal plant,<br>Fish Processing Combine,<br>Murmansk |
| Vitali Smirnov | Captain | Van Dyke, freezer trawler,<br>Murmansk |
| Dr. K. A. Lyamim | Deputy Director and Chief, Herring Laboratory | Polar Research Institute of Marine Fisheries and Oceanography (PNIRO)<br>Knipovichstr. 6,<br>Murmansk |
| Dr. K. G. Konstantinov | Chief | Northwest Atlantic Fisheries Laboratory,<br>Polar Research Institute (PNIRO),<br>Murmansk |
| Dr. P. V. Ponomarenku | Chief | Barents Sea Fisheries Laboratory,<br>Polar Research Institute (PNIRO),<br>Murmansk |
| Dr. L. P. Minder | Chief | Fish Technology Laboratory,<br>Polar Research Institute (PNIRO),<br>Murmansk |
| Nikolai Zhogor | Chief | Automation Department,<br>Polar Research Institute (PNIRO),<br>Murmansk |

Astrakhan

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| Giorgi Uzhinsky | Chief | Technical Department,<br>Caspian General Fisheries Branch (Caspriba),<br>All-Union Ministry of Fisheries,<br>Astrakhan |
| E. Pokrovsky | Deputy Chief | Technical Department,<br>Caspian General Fisheries Branch,<br>All-Union Ministry of Fisheries,<br>Astrakhan |
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| Dr. N. M. Potashnik | Deputy Director and Chief, Technical Division | Caspian Research Institute on Marine Fisheries and Oceanography,<br>Astrakhan |
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| Mrs. M. Kalentarova | Chief | Laboratory for Physical Methods of Fish Processing<br>Technical Division,<br>Caspian Fisheries Research Institute,<br>Astrakhan |
| Mrs. I. A. Shishkanova | Senior Research Officer | Fish Processing Laboratory,<br>Technical Division,<br>Caspian Fisheries Research Institute,<br>Astrakhan |
| Dr. N. Martin | Chief | Fish Diseases Laboratory<br>Biology Division, CASPNIRO,<br>Astrakhan |
| Dr. M. A. Letichevsky | Chief | Fish Reporduction Laboratory<br>Biology Division, CASPNIRO,<br>Astrakhan |
| I. Leksukin | Chief | Commercial Fishing Laboratory,<br>Biology Division,<br>CASPNIRO,<br>Astrakhan |
| Dr. I. Kusmin | Senior Research Officer | Laboratory of Commercial Ichthyology,<br>Biology Division, CASPNIRO,<br>Astrakhan |
| M. I. Panteev | Senior Research Officer | High-frequency Section,<br>Laboratory for Physical Methods of Fish Processing,<br>CASPNIRO,<br>Astrakhan |

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| Mrs. E. V. Netchaieva | Senior Research Officer | Laboratory of Technical Fish Products, Technical Division, CASPNIRO, Astrakhan |
| Mrs. N. V. Tchemerenko | Senior Research Officer | Food Products (Canning) Laboratory, Technical Division, CASPNIRO, Astrakhan |
| Mrs. Popova A. Mikhailovna | Scientific Officer | Astrakhan Museum of Natural History, Astrakhan |
| Dr. Vladimir Minshtein | Director | Central Research Institute for Sturgeon (CNIORH), Astrakhan |
| Valentin Moskalenko | Director | Ikryaninsky Sturgeon Hatchery, Astrakhan |
| Alexander Korochin | Chief | Engineering Department Ikryaninsky Sturgeon Hatchery, Astrakhan |
| G. Kleschevnikov | Captain | Saratov kilka fishing and freezing vessel, Astrakhan |
| Victor Shorin | First Mate, in charge of fish processing | Saratov kilka fishing and freezing vessel, Astrakhan |
| B. Malov | Director | Naval and Technical School of the Fishing Industry, Astrakhan |
| I. Belof | Deputy Director | Naval and Technological School of the Fishing Industry |
| Mrs. Ekaterina Nikitina | Director | Astrakhan Fish Processing Combine, Astrakhan |
| Mrs. Tamara Shkibo | Deputy Director | Astrakhan Fish Processing Combine, Astrakhan |
| Mrs. Nikolai Budirev | Chief | Technical Department Astrakhan Fish Processing Combine, Astrakhan |
| Mrs. Pana Gorbunova | Chief Technologist | Astrakhan Fish Processing Combine, Astrakhan |
| Mrs. Nina Povarova | Chief | Technical Control Office Astrakhan Fish Processing Combine, Astrakhan |
| Alexei Kurianov | Deputy Director | Supply and Marketing Astrakhan Fish Processing Combine, Astrakhan |
| Mrs. Nadezhda Zolotovskaya | Chief Technologist | Caviar Balik Factory, Astrakhan |

Appendix 2

SCHEDULE OF SEMINAR/STUDY TOUR

| Date | Day of week | Subject | Place |
|---|---|---|---|
| | | Arrivals | Moscow |
| May 12-14 | Friday Saturday Sunday | 1. Visit to the Permanent Exposition of the U.S.S.R. Economic Achievements.<br>2. Attendence at Ballet Performance of "Swan Lake" at the Kremlin Palace of Congresses. | |
| 15 | Monday | Opening of Seminar<br>1. Lecture: Brief review of the Soviet fish processing industry, by N. Sysoev<br>2. Lecture: Methods of utilization and processing of fish and other sea products, by T. Makarova | |
| 16 | Tuesday | 1. Lecture: Primary fish (herring) processing, by A. Merenburg<br>2. Lecture: Products development, by R. Kreuzer | |
| 17 | Wednesday | Lecture: Fish smoking, by N. A. Voskresensky | |
| 18 | Thursday | 1. Lecture: Methods and technology of fish canning, by I. Parshin<br>2. Reports by Seminar participants | |
| 19 | Friday | 1. Lecture: Fodder fish meal manufacture, by V. Bodrov<br>2. Reports by Seminar participants | |
| 20 | Saturday | 1. Lecture: Modern methods of fish chilling and freezing, by V. Zaitsev<br>2. Lecture: Production of medical and highly vitaminized fish fats, by L. Lagunov and V. A. Bodrov | |
| 21 | Sunday | Free | |
| 22 | Monday | 1. Lecture: Reception, storage, and distribution of fish products, by S. Gushchan<br>2. Lecture: Mechanization and automation of fish products manufacture, by A. Terentyev | |

| Date | Day of week | Subject | Place |
|---|---|---|---|
| May 22 | Monday 22.00 | Departure for Murmansk by train | |
| 23/24 | Tuesday/ Wednesday | 1. Arrival in Murmansk<br>2. Visit to a freezer stern trawler (Murmansk) and a floating base (Sevryba) | Murmansk |
| 25 | Thursday | Visit to Murmansk fish processing combine | |
| 26 | Friday | 1. Visit to the Polar Research Institute<br>2. Lectures: (a) Fish inspection<br>(b) Training in fish inspection, by H. V. Dempsey | |
| 27/28 | Saturday/ Sunday | Travel to Astrakhan (via Moscow) by train and via Rostov by air | |
| 29 | Monday | Arrival in Astrakhan and installation of staff and participants in local hotel | Astrakhan |
| 30 | Tuesday | 1. Visit to the Caspian Research Institute: reception by the Director, Mr. V. Andreev; visit to the laboratories (Biology Division) Introductory lectures by staff members of the Institute's Technical Division. Continuation of visit to laboratories (Technical Division). Tasting of canned fish products.<br>2. Visit to Astrakhan Museum of Natural History | |
| 31 | Wednesday | 1. Visit to the Ikryaninsky Sturgeon Hatchery; conducted by Dr. V. Minshtein<br>2. Evening - Film show at the Astrakhan Theatre | |
| June 1 | Thursday | 1. Visit to the fishing/freezing vessel Saratov and to the refrigerator of the Astrakhan fish plant<br>2. Visit to the Astrakhan Naval and Technical Fisheries School; and lecture on Canadian Methods and Procedures in Fish Inspection, by H. V. Dempsey<br>3. Sightseeing tour of the city | |
| 2 | Friday | 1. Visit to the Astrakhan Fish Processing Combine's cannery and reception by the Director, Mrs. Nikitina<br>2. Luncheon given by the Administration of the combine | |

| Date | Day of week | Subject | Place |
|---|---|---|---|
| June 2 | Friday | 3. Concert by the song and dance group "Sailor" and orchestra of the U.S.S.R. Navy in the theatre club of the fish processing combine. | Astrakhan |
| | | 4. Farewell party arranged by the participants. | |
| 3 | Saturday | Departure from the Narimanovo Airport to Moscow, via Rostov. | |
| 4 | Sunday | Free | Moscow |
| 5 | Monday | 1. Visit to VNIRO. Reception by the Deputy Director, Dr. T. Makarova. Tour of the technological laboratories and discussions with scientific staff. | |
| | | 2. Summing-up session, chaired by Eng. H. Pimentel of Peru, in the VNIRO meeting hall. | |
| | | 3. Closing ceremony in the VNIRO Meeting Hall. | |
| | | 4. Evening - Farewell dinner at the Moscow Restaurant, given by VNIRO | |
| 6 | Tuesday | Departure of participants. | |

FISH TECHNOLOGY EXPERIMENT STATION
C.F.T.R.I.
MANGALORE.

MR/73415/S.68/E/1/350